REMARKS

Claim 28-33 and 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Empedocles et al, in view of Chan et al and Wamer et al. Claims 28 and 34-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Empedocles et al, in view of Chan et al and Wamer et al. as applied to 28-33 and 36 above and further in view of Knowland et al.

Independent claim 28 has been amended to recite the imposition of a charge transfer intermediary between the semiconductor particle and the biological molecule. Support for this added limitation is found on page 12, lines 7-9.

Claim 36 has been amended to correct a typographical error; specifically FeO_4 was changed to Fe_3O_4, support for which is found on page 14, line 8 of the specification.

Claim 41 has been added to recite an eV value of approximately 2. Support for this recitation is found on page 17, line 15, which recites 600 nm absorption for band shift values of the invented construct, and 600 nm equates to 2 eV per the well-known algorithm $\lambda = hc/\varepsilon$, where λ is 600 nm, h is planck's constant, c is the speed of light, (i.e. hc = 1240) and ε is energy in eV.

Applicants submit that in light of the amendments to claims 28, 31 and 41, the rejections are obviated.

No Art of Record Suggests
Redox Chemistry

Applicants wish to note that clause "d" of claim 28 requires the biological material to change structure. However, the art of record teaches away from structurally changing molecules using visible light.

First, Empodocles is cited for teaching a method for attaching quantum dots to a biological moiety. However, the parent application (filed June 28, 2000, and issued as 6,677,606) predates what Empodocles (filed February 15, 2001) is purported to teach. In light of the foregoing, applicant requests withdrawal of Empodocles as a reference.

Second, applicant's claimed structure-altering chemistry does not exist in Empodocles. Rather, Empodocles merely provides a fluorescent tag to an assay

process, and lists organic dye molecules, metal colloid scattering particles, surface-enhanced Ramon spectroscopy particles and semiconductors as exemplary fluorophores. (See paragraph 0060).

Chan is cited for *in vivo* manipulation. Applicants respectfully disagree. First, like Empdocles, Chan is a mere fluorescing moiety.

Second, Chan teaches *in vitro,* not *in vivo,* applications, as stated at the bottom of column 3 of page 2017. In fact, Chan admits in column 2, page 7018 that improved photostability is required before its construct can be utilized in living cells. As such, Chan does not teach utilizing its quantum dot *in vivo.*

Assuming *in arguendo* that Chan teaches *in vivo* applications it is noteworthy that Chan does not utilize TiO_2 (the applicant has been relegated to TiO2) but rather toxic cadmium moieties as a quantum dot. Second, TiO_2 in used size regime is not a quantum dot. Charges cannot be easily separated in quantum dots to perform the redox chemistry occurring in the instant method. Quantum dots are useful in fluoresence, not in structure-altering reactions.

Wamer has been cited on page 6 of the Official Action as causing photo-oxidation "in the presence of light-activated TiO_2".

First, inasmuch as the restriction requirement relegates the instant invention to visible light, and inasmuch as Wamer states (correctly) on page 851, column 1 that "TiO_2 does not absorb radiation in the visible region of the spectrum", Applicants submit that Wamer teaches away from the instant method.

Second, Wamer cannot work with visible light. Rather, Wamer requires *higher energy* UV (320 nm) excitation of TiO_2 to work. This is because, unlike the construct as now claimed, Wamer does not provide for covalent interaction between semi-conductor particles and nucleotides. (Neither does any other qualifying art of record suggest covalent attachment of semi-conductor particles to biological molecules.)

Instead, Wamer teaches merely suspending semi-conductor particles in solutions containing calf thymus DNA. No covalent attachments exist in Wamer.

Using Wamer's high energy UV light in the instant method does not work either. Given the now claimed charge-transfer intermediary (as recited in claim 1, clause a), a band gap shift occurs on the semi-conductors, such that energy values of 1.6 eV (as recited in amended claim 31) and 2.0 eV (as recited in new claim 41) effect structural changes. "This lower energy value enables the construct's use *in vivo*," (emphasis in original) as originally required in the preamble of independent claim 28 and explained on page 10, lines 19-26 of the instant specification.

The instant method's use of lower energy values is compared to Wamer's energy requirement " **greater than** the optical band gap of TiO2 (3.2 eV..." as stated on its page 851, column 2.) Specifically, and as noted in Wamer's abstract, 320 nm radiation(or 3.8 eV, per the algorithm discussed supra) is required to excite the suspended TiO_2 particles.

Knowland has been cited for suggesting strand breakage. However, as with Wamer, Knowland requires UV radiation, and therefore is not applicable to the invention as now claimed.

That visible light effects cleavage in the instant invention is clarified with the added limitation of a charge transfer intermediary in claim 28. This intermediary lowers the energy threshold between the valence and conductance bands of the TiO2 particle, so as to allow charge separation at lower energy values of 1.6, 2 or 3.2 eV.

None of the art of record suggests structurally modifying biological molecules using visible light. In light of the foregoing, Applicants respectfully request withdrawal of the 103 rejection and allowance of the application.

An earnest attempt has been made hereby to respond to the November 20, 2008 Official Action. All claims are deemed in condition for allowance and the same is respectfully requested. If the Examiner feels that a telephone interview will expedite allowance, he is respectfully urged to call the undersigned. Claims 28-36, and new claim 41 is pending in the application.

Respectfully Submitted,

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